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NUMERICAL CALIBRATION OF COHESIVE ZONE ENERGY FOR PLATE TEARING

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Abstract. In a cohesive zone model, neighboring elements are connected by nonlinear springs (instead of directly sharing a node) which are designed to i) absorb the fracture energy, ii) release the connection between elements in the fracture zone. Unfortunately, it is often necessary to conduct lab tests combined with curve fitting in order to define the potential energy and the peak traction of the nonlinear springs.

The present work extends earlier 2D work¹ by applying a full 3D numerical model to the plate tearing problem. A through thickness discretization of 64 elements, and a total of approximately 500,000 solid finite elements, are used together with the Gurson-Tvergaard-Neddleman model for simulation of growth and collapse of micro-voids in the material. Sub-domains of material between planes perpendicular to the crack growth direction are identified and for each sub-domain the elastic energy, plastic energy, and the force-displacement curve are extracted. These values allow to directly define the cohesive zone parameters without the need to apply a fitting technique on the global traction-separation curve of the crack mouth.

The method is used to subsequently define cohesive zone models of different discretizations and the performance, and validity, of the procedure is demonstrated and discussed in relation to results from the literature².

Keywords: Gurson model, Cohesive Zone, Plate Tearing.

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